

(12) UK Patent Application (19) GB (11) 2 156 033 A

(43) Application published 2 Oct 1985

(21) Application No **8506007**

(22) Date of filing **8 Mar 1985**

(30) Priority data

(31) **8408571**

(32) **21 Mar 1984**

(33) **DE**

(71) Applicant

Festo KG (FR Germany),

Ruiter Strasse 82, 7300 Esslingen, Federal Republic of Germany

(72) Inventor

Kurt Stoll

(74) Agent and/or Address for Service

Swindell & Pearson,

44 Friar Gate, Derby DE1 1DA

(51) INT CL⁴

F16L 11/00 11/12

(52) Domestic classification

F2P 1A12 1A3 F14 F23

(56) Documents cited

GB A 2102909

GB 1516262

GB 0996038

GB A 2060811

GB 1427586

GB 0625987

GB A 2030838

GB 1076819

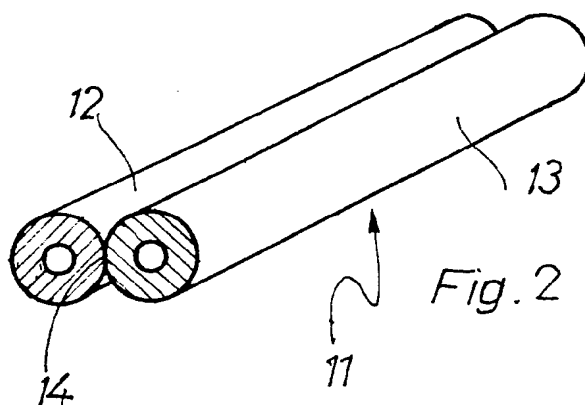
EP 0079787

(58) Field of search

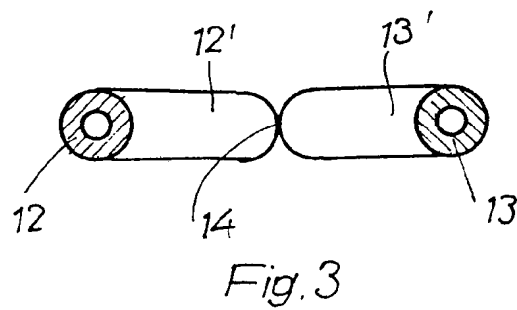
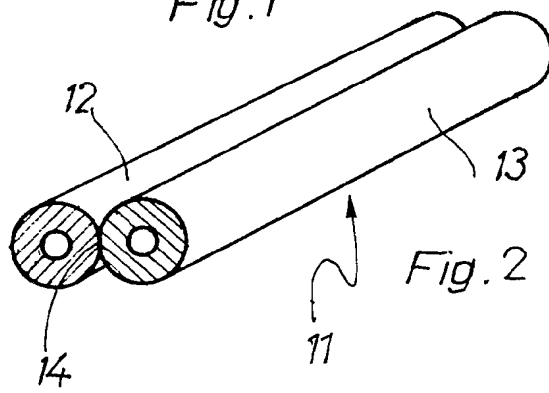
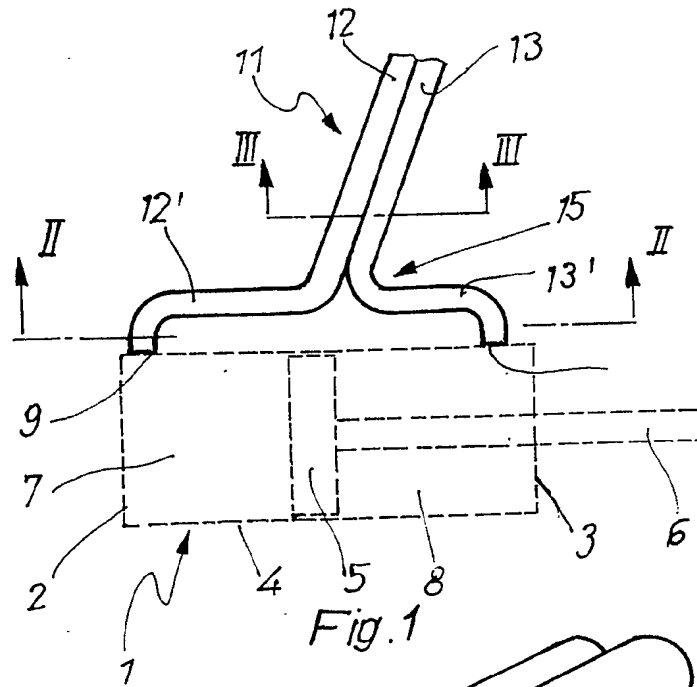
F2P

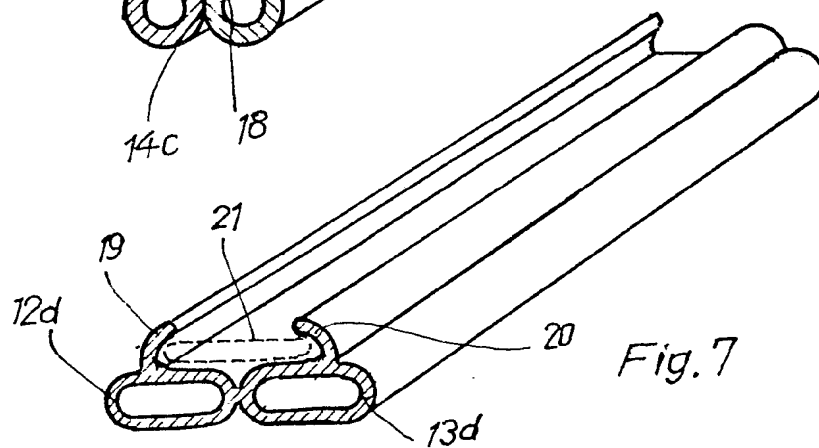
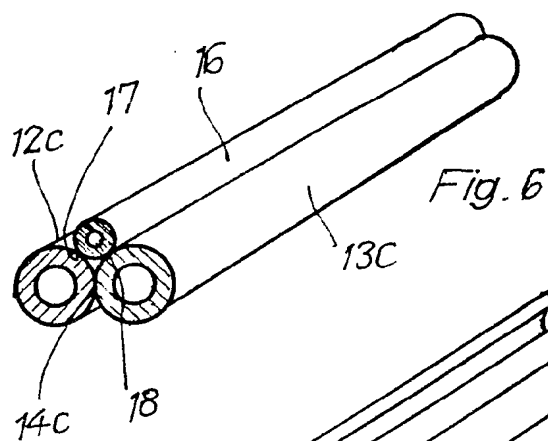
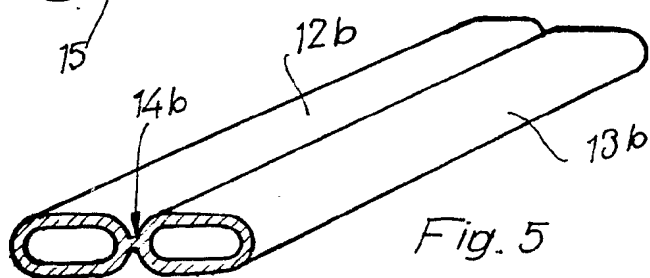
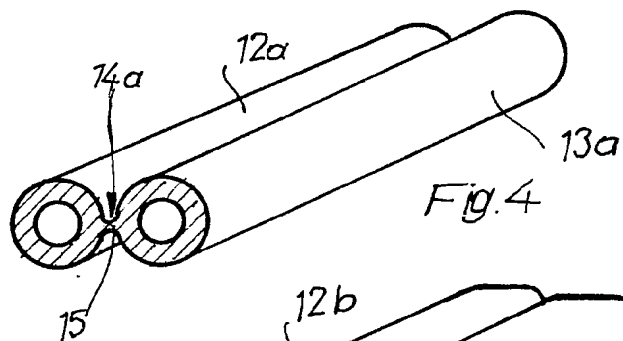
(54) Multiple hose

(57) The pneumatic hose (11) is made of flexible synthetic resin and is adapted for connection with compressed air actuators for the supply and discharge of driving air. The hose (11) is in the form of single piece multiple hose having more especially two hose members (12 and 13) joined to each other along a frangible connection (14) at which they are able to be split apart at one end of the hose for joining to connectors at spaced points on the actuator. An electrical lead (16 Fig. 6 not shown) may be joined to the hose by a frangible connection (17, 18). The hose may be provided with ribs (19, 20 Fig. 7 not shown) for accommodating an electrical lead (21). The frangible connection may be formed by an adhesive or an integral web.



GB 2 156 033 A





SPECIFICATION

Pneumatic hose

5 The invention relates to pneumatic hose made of flexible synthetic resin adapted for connection with compressed air actuators for the supply and discharge of air to and from the actuator.

10 Cylinder actuators with a double acting piston have piston driving spaces on both sides of the piston, air being supplied to and let off from the spaces in accordance with the desired direction of motion, that is to say air is let off from the one piston driving space while the other is being pressurized and vice versa. This supply of compressed air to the piston driving spaces is generally through two separate lengths of hose, such two hoses being connected at one end with the cylinder actuator and at the other end with a multi-way valve controlling the supply of air.

The amount of work that goes into the fitting of such different lengths of hose to the equipment is however considerable, more specially in the case of extensive equipment having a large number of such cylinder actuators. Furthermore, the large number of separate pieces of hose frequently presents an untidy appearance.

30 One aim of the present invention is therefore to design pneumatic hose of the above-mentioned type, that is easier, and for this reason cheaper, to fit. Furthermore the hose is to present a neat appearance.

In order to effect this and other aims in the present invention pneumatic hose is characterized in that it is designed for connection with a compressed air-operated cylinder actuator for the supply to and discharge of air from the actuator, said hose being in the form of a single-piece multiple hose made up of a number of hose members joined together by a frangible connection at which they may be split apart along a desired length thereof.

45 This makes it possible for each cylinder actuator to be fitted with only one single length of hose, i. e. the multiple hose in accordance with the present invention. This makes the work of fitting the hose very much less elaborate and the result is a neat, readily traced arrangement, which does not make the equipment look untidy.

At the end which is to be connected, it is only necessary to split apart the two hose members from each other along such a length that they may reach the appropriate connections of the cylinder actuator. This splitting of the two members from each other may be simply undertaken, seeing that there is the frangible connection for this purpose, by manually pulling the two individual hose members apart.

65 It is convenient if the two separate hose members are bonded along the frangible con-

70 nection or for example attached to each other by way of an intermediate web. While an integral attachment of the two members to each other may be the more satisfactory solution, bonding, viz. joining by applying a layer of adhesive, is superior in the event of it being desired to plug the ends of the two separate hose members into a female connector making sealing contact with the outer face of the respective members. For such an application it is an advantage as regards producing a completely effective sealing function that after the hose members have been parted, the outer surfaces are continuous and smooth at the position of the split bond as well because the bond will have been produced with only an extremely thin layer of adhesive.

The individual hose members may in all cases be circular in cross section so that the multiple hose has a cross section like a figure-of-eight.

For economy in space it may also be an advantage for the individual hose members to have a flattened cross section and to have their narrow sides contiguous. Since the hose material, as is generally the case with synthetic resin hose, is soft in nature it is possible for it to be slipped over the end of a round male connecting member or plugged into a round female connector.

In accordance with a further convenient feature, the multiple hose may have gripping ribs running in the length direction for detachably fixing an electrical lead thereto with the lead between two ribs. This measure may be advantageous for example if the cylinder actuator has a solenoid valve or if there is a limit switch thereon, such switch supplying a signal for reversing the multi-way valve for switching over the supply of compressed air. In cases such as these an electrical lead is needed that may be fixed to the pneumatic multiple hose to create a neat impression and to simplify fitting, the lead simply being clipped between two such retaining ribs. In this respect the detachable connection with the gripping ribs opens up the possibility of joining the electrical lead with the pneumatic multiple hose for only a limited length thereof if the electrical lead is not to run right the way along the hose. It will be clear that by having a greater number of gripping ribs it will be possible for a number of electrical leads to be attached to the multiple hose.

120 In the case a possible alternative design the pneumatic multiple hose possesses at least one electrical lead, running along the hose, encased in synthetic resin, which lead is bonded to at least one of the hose members to form a frangible connection therebetween. This form of the invention is advantageous, no change in the position and length of the lead and of the hose being necessary, the lead being separated from the hose for some length for producing the desired electrical

connection, as has been described for the individual hose members.

A detailed account will now be given of working examples of the invention with reference to the accompanying drawings.

Figure 1 is a diagrammatic elevation of a multiple hose in accordance with the invention as connected to a cylinder actuator.

Figure 2 is a section of the multiple hose of figure 1 taken on the line III-III therein.

Figure 3 is an oblique section of the hose of figure 1 taken on the line II-II.

Figures 4 to 7 are respective views, similar to that of figure 3, of different further possible forms of the invention.

In figure 1 a compressed air operated cylinder actuator 1 is marked in broken lines and comprises a cylinder barrel 4, shut off at its ends by cylinder covers 2 and 4, and a piston 5 able to reciprocate in the length direction of the barrel. A piston rod 6 extends from one side of the piston and passes through the cylinder cover 3 opposite thereto and may be reciprocated by the piston to perform some form of work.

The interior of the cylinder is divided up by the piston 5 into two piston driving spaces 7 and 8 into which compressed air may be supplied via an external connection 9, and let of therefrom by a connection 10, in turn. If compressed air is supplied to the piston driving space 7 on the opposite side of the piston rod 6, then the piston 5 will be displaced to the right with a concomitant increase in the volume of the other piston driving space 7, the compressed air present in the other piston driving space 8 being displaced through the external connection 10 to the outside. Consequently the piston rod 6 is moved out of the cylinder for some of its length. After this forward stroke the supply of compressed air is reversed so that the piston driving space 8 is supplied with compressed air and air is let off from the piston driving space 7.

The supply and discharge of fluid under pressure is by way of a length of pneumatic hose made of flexible synthetic resin which is designed as multiple hose 11 which, prior to fitting to the actuator, has its two halves joined together along its full extent.

Such multiple hose 11 consists of two individual hose members 12 and 13 that are joined along a frangible connection 14, running in the length direction, which may be split apart. Figure 3 shows only part of the length of the multiple hose. In practice such a multiple hose may be supplied in any desired length. And for a given application the amount required may be cut off from the stock of hose.

In order to connect one of the individual hose members 12 or 13 with one of the external connections 9 or 10 of the cylinder actuator which are spaced apart, the two hose members 12 and 13 are broken apart at the

bonded connection therebetween for the desired length starting at the end to be fitted to the actuator so that the result is a hose structure of which a part has its individual hose members (12' and 13') separated from each other and running to the Y-junction 15, beyond which they are united as the multiple hose running to a multi-way valve, not illustrated, controlling the supply and discharge of the compressed air to and from, respectively, the cylinder actuator.

In the case of figures 1 to 3 the two individual hose members 12 and 13 are bonded together forming the longitudinal frangible connection 14, i. e. the intended line of splitting of the hose members. This line-like connection may be produced by applying an extremely thin layer of adhesive so that when later the hose members have been separated the line of bonding will be practically indiscernible and the outer faces of the individual hose members (hose members 12' and 13') will be continuously smooth even at the split connection. As will be seen from figure 3 the individual hose members 12 and 13 are circular in cross section.

The multiple hose in keeping with figure 4 is to be distinguished from that of the hose so far described insofar as here the hose members 12a and 13a are integrally joined along the frangible connection 14a, this form of the invention having the frangible connection embodied in the form of a web 15.

The multiple hose according to figure 5 also possesses hose members 12b and 13b integrally adjoining each other along the frangible connection line 14b. However the members are not spaced from each other by having joining web, but are rather more joined at their peripheries. Furthermore in this case the separate hose members 12b and 13b may be seen to have a flattened form in cross section and their narrow sides are joined together. This form of the hose therefore has a very low overall height so that it needs little space.

It will be clear that each of the forms of frangible connection described may be used with any of the forms of hose cross section so that even the form with the round hose members might have them directly integrally connected, or the flattened hose members as in figure 5 might be bonded together or have an integral connection web as in figure 4.

For connection of the ends of the separate hose members it is possible for them to be slipped over male connectors or into female connectors. In the latter case the bond between the hose members proves useful, since after parting the two hose members at one end the outer face will be smooth all round and still make perfect sealing contact within a female connector. In the case of figure 5 as well a circular connector may be used since the plastic material used is soft and yielding so that when fitted to the connector it will

assume a circular form.

In the working example of figure 6 there are again two hose members 12c and 13c as parts of a multiple hose, it being possible for the frangible connection to be formed in the described manner. Figure 6 additionally shows that the multiple hose may encompass at least one electric lead 16 with a synthetic resin casing, which lead 16, running in the length direction of the hose, is bonded in place on at least one of the hose members by way of a frangible connection. In the working example, the electrical lead 16 is joined to each of the hose members by way of frangible connections 17 and 18, respectively. Only the casing of the electrical lead is shown in figure 6. This form of the invention is suitable for all those applications in which in addition to supplying the cylinder actuator with compressed air, electric current is to be supplied, more especially to the solenoid valve mounted thereon, or if a switch mounted thereon is to produce a signal when the piston reaches a certain position. It is naturally possible, departing from the arrangement of figure 6, to have further electrical leads in the multiple hose in a similar manner. The electrical lead 16 may be split off from the hose for any desired length in the same way as described for the individual hose members.

Although the multiple hose shown in figure 7 is not fitted with any electrical lead, it is however adapted for such purpose and it has integrally formed gripping ribs 19 and 20 running in the length direction between any pair of which an electrical lead may be held. In the working example illustrated there is one such gripping rib 19 and 20 on the two respective hose members 12d and 13d, such gripping webs being placed with a spacing between them on the same side of the multiple hose so that they are opposite each other with a spacing between them. They are bent towards each other somewhat and may be opened out elastically. It is possible for a flat electrical lead, whose end is indicated in broken lines in figure 7 at 21, to be moved inwards radially so as to clip in between the ribs. This form of the invention is particularly well suited for cases in which the electrical lead does not have to be of the same length as the multiple hose.

On the opposite side it is possible to have a further corresponding gripping rib arrangement. Furthermore it is possible for the two individual hose members 12d and 13d to have a circular form in place of the flattened one and for the frangible connections to be different.

CLAIMS

1 Flexible pneumatic hose designed for connection with a compressed air-operated cylinder actuator for the supply to, and discharge of, air from the actuator, said hose being in

the form of a single-piece multiple hose made up of a number of hose members joined together by a frangible connection at which they may be split apart along a desired length thereof.

2 Flexible pneumatic hose as claimed in claim 1 wherein the individual hose members are bonded to each other along the frangible connection.

3 Flexible pneumatic hose as claimed in claim 1 wherein the individual hose members are integrally joined together.

4 Pneumatic hose as claimed in claim 3 wherein the individual hose members are integrally joined together along the frangible connection by way of a joining web.

5 Flexible hose as claimed in any one of the claims hereinbefore wherein said individual hose members are circular in cross section.

6 Flexible hose as claimed in any one of claims 1 to 4 wherein the individual hose members have a flattened form in cross section and have their narrow sides attached to each other.

7 Flexible pneumatic hose as claimed in any one of claims 1 to 6 wherein in their split apart condition the outer faces of the individual hose members are continuously smooth at the position of such frangible connection after splitting.

8 Flexible pneumatic hose as claimed in any one preceding claim comprising integrally formed ribs thereon for gripping an electrical lead between two such ribs.

9 Flexible pneumatic hose as claimed in any one preceding claim comprising at least one electrical lead encased in synthetic resin running in the length direction of the hose and bonded to at least one of the hose members along a further frangible connection.

10 Flexible pneumatic hose as claimed in claim 1 substantially as described above with reference to, and as illustrated in, the figures 1 to 3 of the accompanying drawings.

11 Flexible pneumatic hose as claimed in claim 1 substantially as described above with reference to, and as illustrated in, figure 4 of the accompanying drawings.

12 Flexible pneumatic hose as claimed in claim 1 substantially as described above with reference to, and as illustrated in, figure 5 of the accompanying drawings.

13 Flexible pneumatic hose as claimed in claim 1 substantially as described above with reference to, and as illustrated in, figure 6 of the accompanying drawings.

14 Flexible pneumatic hose as claimed in claim 1 substantially as described above with reference to, and as illustrated in, figure 7 of the accompanying drawings.

15 Any novel subject matter or combination including novel subject matter herein disclosed, whether or not within the scope of or relating to the same invention as any of the preceding claims.

Printed in the United Kingdom for
Her Majesty's Stationery Office, Dd 8818935, 1985, 4235.
Published at The Patent Office, 25 Southampton Buildings,
London, WC2A 1AY, from which copies may be obtained.